Healthy living in hard times

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Abstract:

Using microdata for adults from 1987 to 2000 years of the Behavioral Risk Factor Surveillance System (BRFSS), I show that smoking and excess weight decline during temporary economic downturns while leisure-time physical activity rises. The drop in tobacco use occurs disproportionately among heavy smokers, the fall in body weight among the severely obese and the increase in exercise among those who were completely inactive. Declining work hours may provide one reason why behaviors become healthier, possibly by increasing the non-market time available for lifestyle investments. Conversely, there is little evidence of an important role for income reductions. The overall conclusion is that changes in behaviors supply one mechanism for the procyclical variation in mortality and morbidity observed in recent research. Keywords: Lifestyles; Health investments; Macroeconomic conditions

Article:

Recent evidence indicates that mortality decreases when the economy temporarily deteriorates. Using aggregate data for a panel of the 50 states and district of Columbia over a 20-year period (1972–1991), Ruhm (2000) estimates that a one percentage point rise in unemployment reduces the total death rate by 0.5%. Compared to earlier research, this analysis has the advantage of utilizing fixed-effect (FE) models that exploit within-state changes and so automatically control for time-invariant factors that are spuriously correlated with economic conditions across locations.[1] Other studies use similar methods to document a fall in total fatalities during downturns for 50 Spanish provinces over the 1980–1997 period (Tapia Granados, 2002), 16 German states from 1980 to 2000 (Neumayer, 2004) and 23 OECD countries between 1960 and 1997 (Gerdtham and Ruhm, 2004).[2]

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[1] Widely cited analyses of aggregate time-series data by Brenner (1973, 1975, 1979) reveal a countercyclical variation in admissions to mental hospitals, infant mortality rates and deaths due to cardiovascular disease, cirrhosis, suicide and homicide. However, this research suffers from serious technical flaws (Gravelle et al., 1981; Stern, 1983; Wagstaff, 1985; Cook and Zarkin, 1986) and studies correcting the problems (Forbes and McGregor, 1984; McAvinchey, 1988; Joyce and Mocan, 1993) fail to uncover a consistent relationship between the macroeconomy and health. Instead, the results are sensitive to the choice of countries, time periods and outcomes, with falling unemployment frequently being correlated with worse rather than better health. The lack of robustness is unsurprising, since any lengthy time-series may contain factors that are confounded with economic conditions. For instance, dramatic reductions in joblessness at the end of the great depression were accompaniedby spuriously correlated improvements in health due to better nutrition and increased availability of antibiotics.

[2] A one point decrease in unemployment is estimated to raise total mortality by 0.3–1.1 % in these studies.

Although reductions in external sources of death (such as accidents) account for a small portion of the lower mortality, most of the decrease reflects better health .[3] According to Ruhm (2000), a one point rise in unemployment lowers fatalities from cardiovascular disease, influenza or pneumonia, and liver ailments by 0.4, 0.7 and 0.4%.[4] The gains in health are not limited to reductions in deaths. Using microdata from 1972 to 1981 years of the National Health Interview Survey and controlling for personal characteristics, fixed-effects, general time effects and state-specific trends, a one percentage point rise in unemployment predicts a 1.5% fall in the prevalence of medical problems, a 3.9% decline in acute morbidities and a 1.6% reduction in reports of "bed-days" during the prior two weeks; some chronic conditions also become less common, led by a 4.3% decrease in ischemic heart disease and an 8.7% reduction in intervertebral disk disorders (Ruhm, 2003).

This paper provides evidence that changes in lifestyles provide one reason for the improvements in physical health. Data for adults from 1987 to 2000 years of the Behavioral Risk Factor Surveillance System (BRFSS) indicate that smoking, excess weight and physical inactivity decline when economic conditions worsen. The drop in tobacco use disproportionately involves heavy smokers; the fall in body weight primarily occurs among the severely obese and the increase in exercise for those who were completely inactive. Since each of these is major risk factor, modifications in behavior represent an important mechanism for the countercyclical variation in physical health .[5]

Individuals might adopt healthier lifestyles when the economy weakens because increases in non-market time make it less costly to undertake health-producing activities such as exercise or the consumption of a healthy diet.[6] Reductions in incomes and employment- related stress could also decrease the frequency of "self-medication" by smoking and drinking.[7] The analysis below

[3] The aforementioned analyses all document a strong procyclical variation in traffic fatalities, which occurs at least partly because driving decreases when the economy weakens. Ruhm (2000) estimates that external sources account for 22–26% of the cyclical fluctuation in total mortality.

[4] Gerdtham and Ruhm (2004) document reductions in mortality from cardiovascular disease, influenza/pneumonia and liver ailments during bad economic times. Neumayer (2004) obtains similar results for the first two of these sources but not for deaths from liver disease.

[5] The aforementioned research finds larger fluctuations in morbidity and mortality from sources such as car-diovascular disease, that are likely to be strongly affected by short-term changes in lifestyles, than for those such as cancer that are not. Behavioral changes are not the only reason why physical health might worsen when the economy strengthens. For instance, health may be an input into the production of goods and services. Thus, hazardous working conditions, the exertion of employment and job-related stress could have negative effects, particularly when job hours are extended during short-lasting economic expansions (Baker, 1985; Karasek and Theorell, 1990; Sokejima and Kagamimori, 1998). Employment is considered a health risk in the environmental medicine literature (e.g. see Harber et al., 2001) and some joint products of economic activity, such as pollution, adversely affect health (e.g. see Chay and Greenstone, 2003).

[6] Specifically, this occurs if individuals are not free to vary work hours and macroeconomic downturns lower the price of non-market time through exogenous (to the individual) decreases in employment. If individuals can freely choose hours, the wage rate may be the relevant variable to include in health input and output demand functions.

[7] Previous research provides some support for these possibilities. Alcohol use falls in bad times, with particularly large reductions in heavy drinking (Ruhm, 1995; Freeman, 1999; Ruhm and Black, 2002). Ruhm (2000) presents preliminary evidence that smoking and body weight decline while physical activity increases and diets improve. Chou et al. (2004) find that obesity is negatively related to the time price of (calorie-rich) prepared food and positively correlated with that of cooking (lower calorie) meals at home (with time prices proxied by work hours and the per capita number of restaurants). The time price of medical care may also decrease in bad times if persons employing fewer hours find it easier to schedule medical appointments. Consistent with this, Mwabu (1988) and

suggests that falling work hours are associated with reductions in health risks but provides little indication that the behavioral changes reflect declining incomes.

It is important to recognize that worse health during temporary expansions does not imply negative effects of permanent economic progress. The key distinction is that agents have greater flexibility in consumption, time-allocation and production decisions in the long-run. Transitory increases in output usually require more intensive use of labor and health inputs with existing technologies, while long-term growth results from technological improvements or expansions in the capital stock that push out the production possibility frontier, potentially ameliorating costs to health.[8] Individuals are also more likely to defer health investments in response to temporary than lasting increases in work hours and sustained growth permits the purchase of consumption goods (like safer cars) that improve health.[9]

Two additional points deserve mention. First, although physical health improves when the economy weakens, mental health may deteriorate.[10] Thus, previous research hypothesizing a role for increasing stress in bad economic times (e.g. Brenner and Mooney, 1983; Catalano and Dooley, 1983; Fenwick and Tausig, 1994) may be correct, even while mistaking this to imply a more general decline in health. Second, healthier lifestyles need not be restricted to or concentrated among those becoming newly unemployed. Instead, the stress of job loss could induce negative effects that contrast with benefits for workers whose hours or job-related pressures are reduced.

1. Data and methods

Data are from 1987 to 2000 interview years of the Behavioral Risk Factor Surveillance System, an annual telephone survey of the non-institutionalized adult population administered by the Centers for Disease Control and Prevention. Thirty-four states participated in 1987 and at least 45 throughout the 1990s. Sample sizes are large, exceeding 50,000 in each year analyzed, and increase over time so that the 14-year sample contains almost 1.5 million observations.[11]

The BRFSS consists of core questions, asked by all states in the specified year, and modules included by some states but not others. Most information is comparable over time and across locations. The survey is designed to produce uniform state-specific data measuring progress towards meeting the Healthy People 2010 national health promotion and disease prevention

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Vistnes and Hamilton (1995) report a negative relationship between employment and the utilization of medical care. However, Ruhm (2000, 2003) presents evidence of a procyclical variation in the use of health services.

[8] Ettner (1996) or Pritchett and Summers (1996) provide evidence of a positive relationship between permanent income and health. Graham et al.’s (1992) analysis of U.S. time-series data indicates that mortality rates are negatively (positively) related to permanent (transitory) income. However, Snyder and Evans (2002) find that reduced incomes of the Social Security “notch” beneficiaries are associated with decreased mortality.

[9] In an extension of Grossman’s (1972) health capital framework, Dustmann and Windmeijer (2004) have recently constructed a model where temporary wage increases raise the time spent in market work (due to intertemporal substitution) and reduce health investments, whereas permanent wage growth raises such investments and improves health. Theyprovide evidence supporting these predictions from data in the German Socio Economic Panel.

[10] For instance, both suicides and non-psychotic mental disorders are countercyclical (Ruhm, 2000, 2003).

[11] Persons without phones or in non-residential settings (e.g. military bases, college dorms or institutions) are excluded. No information is provided on youths (under the age of 18) and the data are self-reported. An ideal study design would use panel data (rather than repeated cross-sections) and control for individual fixed-effects. However, existing longitudinal data sets do not have sufficiently large samples to investigate the questions of interest.

objectives, and so considers a variety of health-related behaviors.[12] Specifically, questions on smoking, height and weight are in the core survey in every year, as is information on leisure-time physical activity for all years except 1993, 1995, 1997 and 1999, where it is in modules included by 9, 11, 12 and 11 states.[13] Demographic data on age, sex, education, marital status and race/ethnicity are also available for all years.

1.1. Outcomes

Smoking, the most important preventable cause of disease in the United States, leads to an estimated 430,000 premature deaths annually from increased risk of cancer, coronary heart disease, stroke, respiratory illness and other ailments (Report of the U.S. Preventive Services Taskforce, 1996; U.S. Department of Health and Human Services, 2000). Since tobacco use varies with prices and incomes, reductions in consumption might help to explain why health improves when the economy weakens.[14] Respondents are classified below as “current smokers” if they smoke every day or some days (rather than not at all), with two other dichotomous variables indicating consumption of at least 20 or 40 cigarettes daily.[15]

Obesity is the second leading cause of preventable death and a major risk factor for hypertension, type-2 diabetes, coronary heart disease, stroke, gallbladder disease, respiratory problems and several types of cancer (National Heart, Lung, and Blood Institute, 1998); 300,000 deaths annually are attributed to excess weight and its economic cost was estimated at US$ 117 billion in 2000 (U.S. Department of Health and Human Services, 2001). Binary variables classify persons as “overweight”, “obese” and “severely obese” if their body mass index (BMI) is at least 25, 30 or 35.[16] These definitions, recommended by the National Institutes of Health (National Heart, Lung, and Blood Institute, 1998), have become standard in recent obesity research (e.g. Mokdad et al., 1999; Chou et al., 2004).[17]

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[12] Information on *Healthy People 2010* can be obtained from http://www.health.gov/healthypeople. Further details on the BRFSS are available at http://www.cdc.gov/nccdphp/brfss.

[13] Exercise data are available for 16,141, 23,677, 28,767 and 28,457 individuals in 1993, 1995, 1997 and 1999.

[14] Chaloupka and Warner (2000) provide a comprehensive overview of economic issues related to smoking.

[15] Before 1996, the BRFSS contained a single question on the number of cigarettes smoked per day. Beginning in that year, this information was obtained for daily smokers only, with others asked the average amount smoked on days of tobacco use. Therefore, in these later years, the 20 and 40 cigarette dummy variables were set to one for *daily* smokers exceeding the threshold level of tobacco use. Warner (1978) presents evidence that smoking is substantially understated in self-reported data such as the BRFSS. The main conclusions below will be unaffected, however, if the underreporting is independent of economic conditions.

[16] BMI, defined as weight in kilograms divided by height in meters squared, is a favored method of assessing excess weight because it is simple, rapid and inexpensive to calculate. The cutoffs for being overweight, obese and severely obese are 155,186 or 217 (184, 221 and 258) pounds for a person who is 5 ft 6 in. (6 ft) tall. There is error in self-reported data, most importantly because heavier persons (especially women) tend to understate their weight. I employ a variation of the procedure used by Cawley (2004) to correct for this. The method involves: (1) regressing actual weight (height) on a quadratic of self-reported weight (height) using data from physical examinations and self-reports in the third National Health and Nutrition Examination Survey (NHANES III); (2) taking the coefficients from these regressions to adjust self-reported height and weight in the BRFSS; (3) calculating BMI using the adjusted values for weight and height. I allow for different reporting errors across demographic groups by estimating the equations separately for males and females and including interactions between race (Black versus non-Black) or Hispanic origin and self-reported height or weight.

[17] The severely obese category includes persons with class II (BMI between 35 and 40) and class III(BMI above 40) obesity. This grouping has previously been used by Allison et al. (1999). Low BMI (less than 18.5) may also represent a health risk but fewer than 2% of respondents are “underweight” by this standard and the estimated effect of economic conditions on low weight is always small and statistically insignificant.

Regular physical activity is associated with lower risk of heart disease, diabetes, colon cancer and osteoporosis; exercise also increases muscle and bone mass, is a key component of weight loss efforts, and enhances psychological well-being (U.S. Department of Health and Human Services, 1996, 2000). Using an index included in the BRFSS, dichotomous variables are created indicating physical inactivity and irregular exercise. The reference group of "regular" exercisers participates in an activity or pair of physical activities for at least 20 min three or more times per week. Individuals are "inactive" if they did not take part in any physical activity outside of regular job duties during the month preceding the survey. "Irregular" exercise is the intermediate category.[18]

A final dichotomous outcome defines "multiple" health risks for persons with two or more of the risk factors of current smoking, severe obesity or physical inactivity.

1.2. Explanatory variables

The main proxy for economic conditions is the average percentage of the civilian non-institutionalized state population (aged 16 and over) employed during the three months ending with the survey month. This is often hereafter referred to as the "employment rate". Data are from the Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS) Database.[19] Some specifications instead control for the average employment rate over the preceding 2 years (ending with the survey month) and the change in the last 3 months, relative to the 24-month average. Other models add covariates for annual household incomes (in thousands of 2000 year dollars) and weekly work hours. The former are calculated as weighted averages for BRFSS residents in the state with the same sex, age and education as the respondent. [20] Current Population Survey Outgoing Rotation Group (CPSORG) data are used to estimate a three-month trailing average of the latter for all persons (whether employed or not) in the respondent's state–sex–age–education cell.[21] These "unconditional" estimates account for changes in hours at both the intensive margin (work hours conditional upon employment) and extensive margin (employment probabilities). Finally, some specifications control for the state unemployment rate rather than the percent employed.

Group averages are used for income and work hours because individual values are likely to be simultaneously determined with health status. For instance, a negative association between income and body weight could result from confounding factors or because obesity reduces earnings (Cawley, 2004). Estimates that primarily exploit cross-sectional variation may therefore suffer from omitted variable and endogeneity bias. Those utilizing group-level variations are unlikely to have these problems but will be less precisely estimated.

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[18] The BRFSS also includes a measure of "vigorous" exercise but its definition changed in 1992.

[19] The web-site, http://stats.bls.gov/lau/home.htm, contains information on the LAUS.

[20] The BRFSS reports household income in the ranges: less than US$ 10,000, US$ 10,000–14,999, US$ 15,000–19,999, US$ 20,000–24,999, US$ 25,000–34,999, US$ 35,000–49,999 and US$ 50,000 or above (US$ 50,000–74,999 and 75,000 or above after 1995). For the econometric estimates, individual household incomes are assumed to be at the midpoint of each range and 150% of the (unbounded) top category, converted to 2000 year dollars using the all-items CPI. Average incomes are calculated for 16 groups stratified by sex (male versus female), age (18–24, 25–54, 55–64, 65 and over) and education (no college versus some college).

[21] Data are from the National Bureau of Economic Research "Current Population Survey Merged Outgoing Rotation Groups: 1979–2000" CD-ROM, compiled on May 16, 2002.

The econometric models also include a quadratic in years of age and dummy variables for sex, education (high school dropout, some college and college graduate), race/ethnicity (non-Hispanic Black, other non-Hispanic non-White and Hispanic origin) and marital status (married, divorced/separated and widowed). Information on education or marital status is unavailable for 0.4% of respondents (5660 persons). To avoid excluding these individuals, the relevant regressors were set to zero and missing value dummy variables created.

1.3. Descriptive information

The first column of Table 1 presents unweighted sample means; the second column incorporates BRFSS sampling weights. Weighting has little effect on the prevalence of smoking, body weight, physical activity or multiple health risks; however, females, young adults, minorities and married persons are underrepresented in the raw data.[22] Almost

Table 1
Sample means for selected variables

Variable	Unweighted mean	Weighted mean
Smoking		
Current smoker	23.4%	23.4%
Smokes ≥ 20 cigarettes per day	11.6%	11.4%
Smokes ≥ 40 cigarettes per day	1.7%	1.7%
Height-adjusted weight		
Overweight (BMI ≥ 25)	54.7%	54.1%
Obese (BMI ≥ 30)	19.4%	18.4%
Severely obese (BMI ≥ 35)	5.9%	5.4%
Leisure-time physical activity		
Irregular exercise	27.6%	28.3%
Physically inactive	29.8%	29.4%
Multiple health risks	11.2%	10.8%
Age (years)	46.3	44.3%
Female (%)	49.3%	52.0%
Race/ethnicity		
Non-Hispanic Black	8.4%	9.4%
Other non-Hispanic non-White	3.8%	3.6%
Hispanic origin	5.5%	9.2%
Education		
High school dropout	14.2%	15.1%
Some college	26.1%	25.8%
College graduate	26.3%	25.9%
Education not reported	0.2%	0.2%
Current marital status		
Married/cohabiting	56.9%	62.5%
Divorced/separated	14.9%	10.9%
Widowed	10.9%	7.3%
Marital status not reported	0.2%	0.2%
State-level variables		
% Employed	64.1%	62.9%
Weekly work hours	23.6	23.1
Personal income (US$ 2000)	26139	26774

[22] The weights account for unequalprobabilities ofsample inclusion due to differences in the number oftelephones or adults in the household, and in the probability of selection among the geographic strata included in the survey. The weighted data are representative of the adult population in the state. Remington et al. (1988) indicate that weighted estimates from the BRFSS are comparable to those for in person surveys. Further information on the weighting procedure can be obtained from www.cdc.gov/nccdphp/brfss/ti-weighting.htm.

Note: Data are from 1987 to 2000 years of the BRFSS. Information on state economic conditions is merged in from other sources. The first column shows unweighted means, the second weights observations using BRFSS final sampling weights. Detailed descriptions of the variables are provided in the text of the paper.

one-quarter of the sample smokes, one-ninth consumes a pack or more daily and 2% smoke 40 or more cigarettes per day. Most adults (54%) are overweight; 18% are obese and 5% are severely obese. Twenty-nine percent of respondents engage in no leisure-time physical activity, 42% exercise regularly and 11% have multiple health risks.[23]

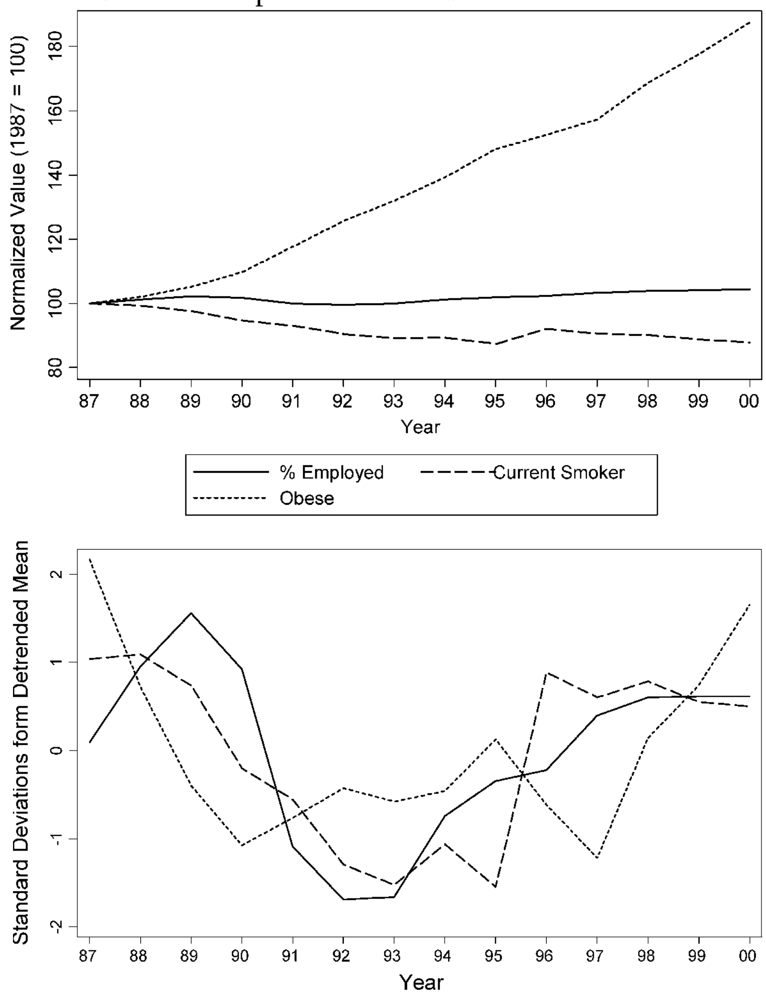

Fig. 1. Trends in employment, smoking and obesity.

Fig. 1 displays trends in employment, obesity and smoking. The top panel shows annual averages, with 1987 values normalized to 100. The employment rate rose 4% over the sample period (from 61.7 to 64.4%), although it declined during the cyclical downturn of the early 1990s. Except for a slight uptick in 1996, adult smoking decreased steadily, falling to 88% of its 1987 value at the turn of the century. By contrast, the obesity "epidemic" is clearly

[23] These results are broadly similar to those obtained from other sources. For example, according to U.S. Department of Health and Human Services (2000), 24% of adults were smokers in 1998, 23% were obese from 1988 to 1994 and 40% engaged in no leisure-time physical activity in 1997. Chou et al. (2004) show that obesity may be understated in the BRFSS, particularly for women, even adjusting for self-report bias.

demonstrated, with the prevalence of obese adults rising 87% (from 13.1 to 24.5%) over the 14-year period .[24]

In the lower panel, the variables are detrended (using a linear trend for months elapsed since January 1987) and transformed to have a mean of 0 and a standard deviation of 1. Previewing the results to follow, the percent employed is positively related to both smoking and obesity.[25] Although these correlations may suffer from the aforementioned problems of confounding, since they primarily exploit time-series variation in national data over a single business cycle, they provide a first indication of the movement towards healthier lifestyles in hard economic times.

1.4. Methods

The basic econometric specification is:

$$Y_{ijmt} = \alpha_j + \mathbf{X}_{ijmt}\beta + E_{mjt}\gamma + \delta_m + \lambda_t + \varepsilon_{ijmt}, \tag{1}$$

where Y is the outcome for individual i living in state j interviewed in month m of year t, X a vector of individual characteristics, E measures economic conditions, E is a regression disturbance, and a, S and X represent unobserved determinants of lifestyle behaviors associated with the state, calendar month and survey year. Since the dependent variables are dichotomous, binary probit models are estimated.

The month dummy variables control for seasonal variations, such as a decline in physical activity when the weather gets cold. The state fixed-effect holds constant differences across locations that are time-invariant, like disparities in smoking between Nevada and Utah. The year effect accounts for factors that vary uniformly over time across states, such as changes in the calorie-content of meals in fast-food restaurants. The macroeconomic consequences are therefore identified by intra-state variations, relative to the corresponding changes in other states.[26] A requirement for the fixed-effect estimates to improve on aggregate time- series analysis is that there are substantial independent economic fluctuations across states over time. This condition is met. For instance, the R-squared for an equation regressing state employment rates on the national rate is just 0.04.[27]

2. Lifestyles get healthier in bad times

Evidence from a variety of econometric specifications demonstrates that lifestyles become healthier when economic conditions worsen. Table 2 provides initial estimates of the predicted effect of a one point increase in the percent of the state population employed on smoking, obesity, physical inactivity and multiple health risks.[28] All specifications control for individual characteristics, month and year dummy variables and state fixed-effects. Parameter estimates for

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[24] The proportion overweight increased 32% (from 46.6 to 61.4%); severe obesity grew 136% (from 3.4 to 7.9%).
[25] The correlation between (detrended) employment rate and smoking (obesity) is 0.762 (0.253) with a standard error of 0.187 (0.279)
[26] Discussions of "cyclical" variations or "macroeconomic" effects therefore refer to fluctuations within states rather than at the national level and terms like "expansion", "downturn" or "recession" indicate changes in the state economic conditions, rather than technical definitions based on GDP fluctuations or the official timing of recessions.
[27] Ruhm (2000) provides a more detailed discussion of this issue and additional supporting evidence.
[28] A one percentage point rise in employment corresponds to an increase of 0.270 standard deviations.

these regressors are consistent with those obtained in previous research (see Table A1 for selected results).[29] The Huber–White sandwich estimator is

Table 2
Predicted effect of a one point increase in the percent employed on lifestyle behaviors

Outcome	Sample mean	Predicted effect	Percent change (a)	Percent change (b)
Tobacco use				
Current smoker	0.2336	0.1317 (0.0287) [0.0489]	0.6	0.6
Smokes ≥ 20 cigarettes daily	0.1144	0.1044 (0.0194) [0.0349]	0.90	1.0
Smokes ≥ 40 cigarettes daily	0.0174	0.0155 (0.0055) [0.0065]	0.9	1.4
Body weight				
Overweight (BMI ≥ 25)	0.5413	−0.0288 (0.0349) [0.0504]	-0.0	-0.0
Obese (BMI ≥ 30)	0.1837	0.0730 (0.0265) [0.0476]	0.4	0.4
Severely obese (BMI ≥ 35)	0.0535	0.0433 (0.0149) [0.0242]	0.8	0.8
Leisure-time physical activity				
Irregular exercise or physically inactive	0.5771	0.1549 (0.0581) [0.1762]	0.3	0.3
Physically inactive	0.2994	0.2056 (0.0569) [0.1656]	0.7	0.7
Multiple health risks	0.1077	0.1215 (0.0257) [0.0551]	1.1	1.2

Note: Table shows the predicted effects of a one point increase in the state percentage of the population employed, from binary probit models using data from 1987 to 2000 BRFSS. The dependent variable means incorporate sampling weights. The probit models also include month, year and state dummy variables and controls for age, sex, race/ethnicity, education and marital status. Multiple health risks refer to individuals with two or more of the following characteristics: current smokers, severely obese or physically inactive. Sample sizes are 1,490,249 for the smoking outcomes, 1,440,665 for body weight, 1,081,829 for physical activity and 1,039,976 for multiple health risks. Predicted effects indicate the estimated percentage point change in the dependent variable, with other regressors evaluated at the sample means. Robust standard errors, calculated assuming that observations are independent across months and states but not within states in a given month, are reported in parentheses. Corresponding standard errors that assume independence across but not within states are shown in brackets. Percentage changes are computed by dividing the predicted effect by the dependent variable mean. In the third column, predicted effects are evaluated at the regressor means. In the fourth, these are calculated for each individual and then averaged across all sample members.

[29] Obesity and sedentary lifestyles are relatively common among minorities and females; Whites and males are more frequent smokers; less educated persons disproportionately suffer from all three health risks; and married individuals rarely smoke or are obese, despite relatively low rates of physical activity.

used to calculate robust standard errors, with the entries in parentheses estimated assuming that observations are independent across states and calendar months but not within states in a given month, while those in brackets (shown only in this table) are calculated with clustering at the state level, rather than the state and month.[30]

The first column displays (weighted) mean values of the dependent variables. The second shows the predicted effect of a one point rise in employment on the percentage of adults with the designated health risk, with other explanatory variables evaluated at the sample averages. The last two columns supply estimates of percentage changes in the outcome. The third column does so by dividing the predicted effect (from the second column) by the dependent variable mean.[31] The fourth calculates the change for each respondent (using individual regressor values) and then averages across sample members before dividing by the sample mean. The estimated percentage changes are virtually identical using either method or subsequent tables display results of only the first procedure.

Risky behaviors become less common when the economy deteriorates. A one point drop in the employment rate reduces the estimated prevalence of smoking, obesity and physical inactivity by 0.13, 0.07 and 0.21 percentage points (0.6, 0.4 and 0.7%). The decline in tobacco use is concentrated among moderate or heavy smokers, which is interesting given evidence by Ruhm and Black (2002) that cyclical variations in alcohol use are similarly dominated by changes in heavy drinking. Results not displayed indicate that there is a slight decline in average body weight.[32] This is largely due to a statistically significant 0.04 percentage point (0.8%) estimated decrease in severe obesity, which accounts for three-fifths of the 0.07 point drop predicted for overall obesity (which includes the severely obese); conversely, there is little change in the anticipated prevalence of overweight. The growth in exercise reflects a 0.21 percentage point (0.7%) reduction in complete inactivity, which is larger than the estimated decrease in combined inactivity and irregular exercise. Finally, the 0.12 point (1.1%) expected decline in multiple health risks is greater in relative terms than the reduction in any single unhealthy behavior.[33]

Table 3 demonstrates that the results are robust to changes in samples and specifications. Column (a) repeats findings of the basic model. Specification (b) more fully utilizes the limited demographic information available in the BRFSS by adding interactions between

[30] Clustering by state and month is important because employment rates take the same values for respondents interviewed in a state during a given month and year. Standard errors clustered only on states are also presented given Bertrand et al.'s (2004) concern that serial correlation sometimes leads to severe understatement of the standard errors in difference-in-difference estimates. This problem is much less severe in my application than in their simulations because extensive regression controls are included and the key explanatory variables exhibit considerable variation over time—whereas Bertrand et al. analyze legislation dummy variables equal to zero (one) for all years before (after) enactment. I therefore mostly focus on standard errors with state–month clustering.

[31] For instance, a 0.13 percentage point reduction in current smoking represents a 0.6% decrease from the base of 23.36%.

[32] A one point drop in employment is predicted to reduce BMI by 0.64 kg/m^2, with a standard error of 0.32 kg/m^2.

[33] As an alternative to using the three-month trailing average of the employment rate, I estimated specifications that controlled for the percent employed during only the survey month. The results were similar to those presented in Table 2, although the effects were slightly attenuated (the coefficients typically fell 1–20% in absolute value), as expected, since the one-month rates are measured with greater error and allow less time for health behaviors to adjust to changing economic conditions.

Table 3
Additional econometric estimates of the effect of a one point increase in the percent employed

Outcome	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Current smoker	0.1317 (0.0287)	0.1350 (0.0288)	0.1297 (0.0288)	0.2327 (0.0496)	0.1189 (0.0347)	0.2258 (0.0464)	0.2014 (0.0628)	0.1439 (0.0456)
Smokes ≥ 20 cigarettes daily	0.1044 (0.0194)	0.1058 (0.0193)	0.1072 (0.0194)	0.1600 (0.0304)	0.0740 (0.0232)	0.1592 (0.0325)	0.1732 (0.0417)	0.1189 (0.0306)
Smokes ≥ 40 cigarettes daily	0.0155 (0.0055)	0.0156 (0.0056)	0.0156 (0.0055)	0.0157 (0.0097)	0.0038 (0.0070)	0.0146 (0.0100)	0.0345 (0.0124)	0.0192 (0.0087)
Overweight (BMI ≥ 25)	−0.0288 (0.0349)	−0.0254 (0.0350)	−0.0265 (0.0352)	−0.0119 (0.0580)	−0.0629 (0.0426)	−0.1081 (0.0548)	−0.0209 (0.0751)	−0.0432 (0.0558)
Obese (BMI ≥ 30)	0.0730 (0.0265)	0.0745 (0.0266)	0.0748 (0.0267)	0.0863 (0.0448)	0.0661 (0.0319)	0.0626 (0.0378)	0.0202 (0.0587)	0.0507 (0.0427)
Severely obese (BMI ≥ 35)	0.0433 (0.0149)	0.0437 (0.0149)	0.0476 (0.0150)	0.0300 (0.0246)	0.0375 (0.0175)	0.0417 (0.0193)	0.0489 (0.0330)	0.0751 (0.0243)
Irregular exercise or physically inactive	0.1549 (0.0581)	0.1593 (0.0582)	0.2057 (0.0573)	0.0638 (0.0870)	0.0419 (0.0690)	0.2086 (0.0814)	0.4311 (0.1116)	0.4105 (0.0847)
Physically inactive	0.2056 (0.0569)	0.2061 (0.0570)	0.2558 (0.0563)	0.1521 (0.0782)	0.0628 (0.0688)	0.1972 (0.0784)	0.7052 (0.1241)	0.4454 (0.0856)
Multiple health risks	0.1215 (0.0257)	0.1236 (0.0257)	0.1400 (0.0254)	0.1356 (0.0411)	0.0923 (0.0315)	0.2052 (0.0361)	0.3025 (0.0591)	0.1937 (0.0395)
Regression details	Basic model	Covariate interactions	Region–month effects	Weighted estimates	State time trends	1987–1994 Period	Slow growing states	Unemployment rate

Note: See note in Table 2. Predicted effects are calculated with the independent variables evaluated at the sample means. Specification (b) includes 13 supplementary regressors interacting age and sex, age and race/ethnicity, sex and race/ethnicity, sex and marital status and sex and education. Column (c) includes interactions between the four census regions (northeast, midwest, south and west) and calendar month dummy variables. Model (d) incorporates sampling weights. Specification (e) includes state-specific linear time trends (months elapsed since January 1987). Column (f) limits the sample to the 1987–1994 period and model (g) to the 10 states with the slowest population growth rate between 1990 and 2000 (North Dakota, West Virginia, Pennsylvania, Connecticut, Maine, Rhode Island, Ohio, Iowa, New York and Massachusetts). Specification (h) controls for the state unemployment rate, rather than the percent employed, and displays the expected impact of a one percentage point decrease in unemployment.

age and sex (one variable), age and race/ethnicity (three variables), sex and race/ethnicity (three variables), sex and marital status (three variables), and sex and education (three variables). This has essentially no effect on the employment coefficients. Column (c) allows the calendar month effects to differ across the four census regions (northeast, midwest, south and west) which might be important, for example, if physical activity declines more during the winter in the northeast or midwest than in the south. The results are close to those in the basic model but with somewhat stronger estimated effects for physical activity. Column (d) incorporates sampling weights. The coefficients again suggest a procyclical variation in smoking, obesity, physical inactivity and multiple health risks although, as might be expected, the standard errors increase.[34]

Specification (e) includes state-specific linear time trends in an attempt to account for unobserved factors that vary within-states over time (such as social norms related to smoking and exercise). Doing so reduces the predicted macroeconomic effects on smoking, physical activity and multiple health risks. This is no surprise, since the trends absorb approximately one-third of the variation in employment rates remaining after controlling for state, month and year effects. It is noteworthy that the estimates for obesity and severe obesity scarcely change, even while the relationship between the percent employed and prevalence of overweight becomes significantly negative. Chou et al. (2004) emphasize that the strong secular increase in excess body weight makes identification difficult in models that contain time trends and recommend against controlling for them.[35] Thus, the sensitivity of some outcomes is not surprising and, following their reasoning, I exclude trends hereafter.

As an alternative, column (f) limits analysis to the 1987–1994 period. Decreasing the number of years is likely to reduce the influence of within-state changes in omitted factors, since the size of the trend component declines relative to fluctuations around it; 1987–1994 is particularly interesting, since there is no trend in national employment (or unemployment) rates during this time span. The standard errors are somewhat higher for this subsample, due to the smaller

[34] Wooldridge (1999) and Butler (2000) demonstrate that weighting reduces efficiency if sampling is based on exogenous variables and the conditional distribution is correctly specified. Absent evidence that these conditions are violated, I emphasize the results of unweighted regressions.
[35] They go even further in preferring estimates that exclude both time trends and general year effects.

number of observations, but the procyclical variations in smoking, physical inactivity and multiple health risks are if anything even stronger than before, while the results for obesity and severe obesity are little changed.

The effects of national business cycles could differ from the state level fluctuations examined here. One reason is that migration flows respond strongly to changes in local economic conditions (Blanchard and Katz, 1992). This mobility is likely to militate against finding healthier lifestyles when the economy weakens, since migrants tend to be young and healthy and usually relocate into areas with robust economies. However, other mechanisms could operate in the reverse direction. For instance, recent arrivals may be unfamiliar with recreational opportunities or be investing large amounts of time settling into their new locations, raising the cost of undertaking healthy behaviors.

Specification (g) addresses this issue by restricting analysis to the 10 states with the slowest rate of population growth (during the 1990s). Movement into these areas occurs relatively rarely, implying that comparatively small cyclical fluctuations would be expected if the negative effects of economic upturns result from in-migration. Instead, the procyclical variations in physical inactivity, tobacco use and multiple health risks are substantially stronger for these states than for the full sample, with little difference for severe obesity.[36]

In model (h), the unemployment rate is used as an alternative proxy of macroeconomic conditions, with the expected impact of a one percentage pointfall in joblessness displayed. The results once again suggest that lifestyles become healthier when economic conditions deteriorate.[37] Specifically, growth in unemployment is correlated with reductions in smoking, obesity, physical inactivity and multiple health risks, with stronger effects estimated for most outcomes than when using employment rates.

3. Population subgroups

Table 4 provides results for subsamples stratified by employment status, education, sex and race/ethnicity. For each group, the first column shows the (weighted) mean of the dependent variable, the second displays marginal effects (with other explanatory variables evaluated at the sample averages) and the third indicates percentage changes.

Despite significant differences in lifestyles, a procyclical pattern of unhealthy behaviors is observed for all groups. The predicted effects are of equal size or larger for working individuals than for the full sample—a one point drop in the percent employed is estimated to lower smoking, obesity, severe obesity, physical inactivity and multiple health risks by 0.6, 0.5, 1.0, 0.5 and 1.1% for employed individuals versus 0.6, 0.4, 0.8, 0.7 and 1.1% for the full sample.[38] This makes it unlikely that the macroeconomic effects are concentrated among those losing jobs in bad times.

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[36] The weaker effect predicted for overall obesity is consistent with a role for migration effects but the coefficient is imprecisely estimated.

[37] Using annual data for the United States, during the sample period, a one point increase in the percentage of the population employed is predicted to be accompanied by a 0.98 percentage point reduction in unemployment.

[38] However, the composition of employment may vary with macroeconomic conditions. For instance, persons with unhealthy lifestyles may have an easier time finding work when the economy is strong.

The findings suggest bigger (but imprecisely estimated) variations in excess body weight for males and minorities than for females and non-Hispanic Whites. For instance, the one point drop in employment is predicted to reduce severe obesity by 1.1, 2.0 and 1.5% among males, Blacks and Hispanics compared to 0.7% for females and 0.3% for Whites. These results are salient given the high rates of obesity and associated conditions, such as type-2 diabetes, for non-Whites and of early male deaths from cardiovascular disease.

If healthier lifestyles in bad times reflect reductions in job-related stress or increases in non-market leisure time, the changes are likely to be concentrated among groups with high labor force attachments (such as males) or large cyclical fluctuations in employment (like minorities). Consistent with this, the weight loss of Blacks, Hispanics and men is accompanied by relatively large increases in physical activity—a one point fall in employment is anticipated to reduce inactivity by 1.0, 1.3 and 1.0% for these groups compared to 0.3% for Whites and 0.4% for females. Conversely, smoking patterns are often quite different (e.g.

Table 4

Predicted effects of macroeconomic conditions on the lifestyle behaviors of population subgroups

Group	Current smoker			Obese			Severely obese			Physically inactive			Multiple health risks		
	μ	β	Δ (%)	μ	β	Δ (%)	μ	β	Δ (%)	μ	β	Δ (%)	μ	β	Δ (%)
Full sample	0.2336	0.1317 (0.0287)	0.6	0.1837	0.0730 (0.0265)	0.4	0.0535	0.0433 (0.0149)	0.8	0.2994	0.2056 (0.0569)	0.7	0.1077	0.1215 (0.0257)	1.1
Employed	0.2529	0.1423 (0.0370)	0.6	0.1786	0.0850 (0.0334)	0.5	0.0503	0.0515 (0.0187)	1.0	0.2670	0.1239 (0.0605)	0.5	0.1066	0.1134 (0.0311)	1.1
No college	0.2872	0.1984 (0.0448)	0.7	0.2111	0.0770 (0.0193)	0.4	0.0644	0.0475 (0.0233)	0.7	0.3876	0.2745 (0.0762)	0.7	0.1533	0.1872 (0.0441)	1.2
Some college	0.1842	0.0761 (0.0351)	0.4	0.1586	0.0493 (0.0346)	0.3	0.0435	0.0282 (0.0188)	0.6	0.2057	0.1363 (0.0558)	0.7	0.0652	0.0665 (0.0264)	1.0
Males	0.2537	0.0892 (0.0441)	0.4	0.1801	0.0750 (0.0414)	0.4	0.0442	0.0475 (0.0209)	1.1	0.2726	0.2702 (0.0696)	1.0	0.1066	0.1704 (0.0358)	1.6
Females	0.2151	0.1660 (0.0351)	0.8	0.1870	0.0762 (0.0337)	0.4	0.0624	0.0419 (0.0204)	0.7	0.3145	0.1777 (0.0641)	0.6	0.1087	0.0937 (0.0315)	0.9
Whites	0.2393	0.1198 (0.0321)	0.5	0.1749	0.0458 (0.0293)	0.3	0.0489	0.0223 (0.0162)	0.5	0.2749	0.1754 (0.0593)	0.6	0.1046	0.1108 (0.0281)	1.1
Blacks	0.2341	0.0171 (0.0838)	0.1	0.2583	0.1758 (0.0933)	0.7	0.0941	0.1874 (0.0620)	2.0	0.3759	0.3733 (0.1582)	1.0	0.1433	0.1250 (0.0872)	0.9
Hispanics	0.1953	−0.0018 (0.1267)	−0.0	0.2090	0.1514 (0.1247)	0.7	0.0591	0.0904 (0.0715)	1.5	0.3750	0.5048 (0.1768)	1.3	0.1065	0.2075 (0.1094)	1.9

Note: See note in Table 2. The regression equations correspond to the specification used in that table. For each outcome, the first column shows the (weighted) mean of the dependent variable, the second displays the predicted effects of a one point increase in the percent employed, evaluated with the regressors set to the sample means and robust standard errors shown in parentheses. The third column indicates the percentage change, calculated by dividing the marginal effect by the dependent variable mean. The samples of "Whites" and "Blacks" are limited to non-Hispanics. Sample sizes for employed individuals range between 651,003 and 927,905; for those without college from 491,744 to 702,559; for the college educated from 546,623 to 784,552; for males from 442,467 to 618,633; for females from 597,509 to 871,616; for Whites from 856,317 to 1,226,121; for Blacks from 87,386 to 124,913; and for Hispanics from 56,040 to 82,271.

larger variations for females than males) suggesting that other mechanisms may be needed to explain the macroeconomic effects on tobacco use.[39]

4. Mechanisms

Table 5 tests whether changes in incomes or leisure time help to explain the fluctuations in lifestyles. Specification (a) repeats findings of the basic econometric model. Column (b) adds state–age–sex–education group average household incomes and weekly work hours as supplementary regressors. We anticipate obtaining positive parameter estimates for income and hours if these factors account for a portion of the macroeconomic effects, since both increase in good times .[40] In this case, their inclusion is likely to attenuate the predicted effect of changes in the percent of the population employed. On the other hand, income growth during economic expansions might promote healthier lifestyles and controlling for it may increase the magnitude

[39] The point estimates suggest smaller macroeconomic effects on current smoking for Blacks than Whites but the pattern is reversed for tobacco use of one or more packs per day.

[40] A one point rise in the percent employed is estimated to raise average household incomes by US$ 205 per year (in 2000 year dollars) and work hours by 0.25 per week in models that control for year, state and month dummy variables and individual characteristics.

of the employment coefficient, if higher incomes are unanticipated and health has a positive income elasticity.[41]

The data provide little evidence of a role for cyclical variations in incomes. A rise of US $ 1000 per year boosts the estimated prevalence of obesity by 0.07 percentage points (0.4%) and severe obesity by 0.01 points (0.2%), but is unrelated to smoking and correlated with a significant 0.13 point (0.4%) decrease in physical inactivity. However, limitations in the BRFSS and in the methods of analysis should be kept in mind, however, when interpreting this result.[42]

By contrast, the hours coefficients are uniformly positive, as expected if healthier living during hard economic times is due to decreases in time prices or job-related stress. Working one more hour per week predicts a slight 0.01 percentage point (<0.1%) rise in smoking but larger 0.05, 0.02, 0.31 and 0.04 point (0.2, 0.3, 1.0 and 0.4%) growth in obesity, severe obesity, physical inactivity and multiple health risks. Stronger effects for excess weight and exercise than smoking make sense, since longer hours constrain time-intensive activities such as physical activity and preparing home cooked meals but less directly affect tobacco use.

Controlling for income and hours attenuates the parameter estimates on the percent employed by 2, 37,16, 29 and 9% in the smoking, obesity, severe obesity, physical inactivity and multiple health risk equations (see column b). This probably provides a lower-bound

Table 5
Additional estimates of the effects of economic factors on lifestyle behaviors

Regressor	Current smoker			Obese			Severely obese			Physically inactive		Multiple health risks	
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(a)	(b)
Employed (%)	0.1317	0.1291	0.1197	0.0730	0.0458	0.0402	0.0433	0.0366	0.0321	0.2056	0.1455	0.1215	0.1111
	(0.0287)	(0.0291)	(0.0296)	(0.0265)	(0.0269)	(0.0270)	(0.0149)	(0.0152)	(0.0150)	(0.0569)	(0.0570)	(0.0257)	(0.0262)
Household income		−0.0105	−0.0032		0.0670	0.0741		0.0099	0.0131		−0.1344		−0.0366
		(0.0079)	(0.0079)		(0.0073)	(0.0073)		(0.0041)	(0.0040)		(0.0120)		(0.0067)
Work hours		0.0102	−0.0083		0.0453	0.0292		0.0168	0.0099		0.3063		0.0436
		(0.0078)	(0.0073)		(0.0061)	(0.0061)		(0.0036)	(0.0036)		(0.0084)		(0.0060)
Irregular exercise			4.705			3.321			1.556				
			(0.1072)			(0.1043)			(0.0641)				
Physically inactive			9.018			6.998			3.745				
			(0.1184)			(0.1132)			(0.0716)				

Note: See note in Table 2. Table shows the predicted effect of a one unit change in the specified variable from probit models that also control for personal characteristics and month, state and year dummy variables. Household incomes, in models (b) and (c), refer to average annual incomes in the state and survey year (in thousands of 2000 year dollars) for 16 groups stratified by age, sex and education. These are estimated with incomes calculated as the midpoints of the ranges of six or seven bounded categories and 150% of the unbounded top category. Work hours refer to average weekly hours in all jobs during the three months ending with the survey month for adults (employed or not) in the same state–age–sex–education cell as the respondent. Further details are provided in the text.

on the role of these factors, since the use of group averages introduces considerable noise into the models. Nevertheless, this procedure is preferable to using individual values which may be contaminated by endogeneity and omitted variables biases.

Specification (c) adds regressors for physical activity to the smoking and body weight models. There are two rationales for doing so. First, obesity may decline in bad times because individuals

[41] There will generally be weaker pure income (or wealth) effects on health for more fully anticipated changes. For example, Grossman (1973) shows that there are larger income elasticities of consumption for cyclical than seasonal unemployment, as expected, since the former are harder to anticipate.
[42] The BRFSS only lists income by category and approximately 13% of respondents are in the top (unbounded) category. The use of group averages may not fully capture the impact of variations in permanent income caused by unanticipated unemployment or fluctuations in work hours and may combine the effects of cyclical and permanent changes in income.

have more time to exercise. Second, tobacco use and activity levels are likely to be negatively correlated, although the direction of causation is uncertain.[43]

Compared to the basic specification (model a), the inclusion of controls for physical activity, household incomes and work hours decreases the employment rate coefficients by 9, 45 and 26% for smoking, obesity and severe obesity (see column c). Sedentary lifestyles strongly predict excess weight and tobacco use, as expected, and controlling for exercise eliminates the negative hours coefficient observed for smoking in model (b) and attenuates that for obesity and severe obesity. This suggests that one reason why employment hours are positively related to tobacco use and excess weight is because individuals have less time or inclination to exercise when working intensively.

5. Adjustment paths

It may seem surprising that the previous econometric specifications, which control for employment rates during only a three-month period, are able to detect effects for lifestyle behaviors that probably respond slowly to changes in macroeconomic conditions. For instance, body weight represents a stock that is determined by the accumulated flows of calorie intake and expenditure, and behaviors like smoking may also change gradually or respond differently in the short-run than in the medium-term. However, since employment rates are highly correlated over time, the previous estimates are actually capturing the effects of macroeconomic influences over a considerably longer period than three months.[44]

Table 6 provides information on the adjustment process by summarizing the results for specifications that control for the percent employed during the two years ending with the survey month and the change during the prior quarter relative to the 24-month average. The findings suggest that the macroeconomic effects accumulate over time. Reduced employment during the previous two years almost always predicts large and statistically significant drops in unhealthy behaviors: a one point decrease lowers expected smoking, obesity, severe obesity, physical inactivity and multiple health risks by 0. 16, 0.11, 0.07, 0.31 and 0.16 percentage points (0.7, 0.6,1.3,1.1 and 1.5%). Conversely, a decline in employment during just

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[43] Smoking may decrease the interest or ability of individuals to engage in physical activity; however, some research (e.g. Marcus et al., 1999) suggests that exercise plays an important role in decreasing or stopping tobacco use. Some indication of the importance of reverse causation (from smoking to exercise) was obtained by estimating IV models with physical inactivity or irregular exercise as outcomes and smoking instrumented by sum of real state and federal cigarette taxes during the calendar quarter of the survey (using data from Orzechowski and Walker, 2001, provided to me in machine-readable form by Michael Grossman and Frank Chaloupka). These estimates provide no indication that smoking causes physical inactivity (instead, there is a small and statistically insignificant negative relationship) but are consistent with a slight decrease in regular exercise.

[44] For example, the *R*-squared between the quarterly employment rate and the average rate during two years concluding with the survey month is 0.932.

Table 6
Initial and medium-term effects of changes in macroeconomic conditions

Outcome	24-Month employment rate		Difference between quarterly and 24-month employment rate	
	β	Δ (%)	β	Δ (%)
Current smoker	0.1611 (0.0330)	0.7	0.0696 (0.0433)	0.3
Smokes ≥ 20 cigarettes daily	0.1284 (0.0225)	1.1	0.0548 (0.0295)	0.5
Smokes ≥ 40 cigarettes daily	0.0202 (0.0065)	1.2	0.0058 (0.0087)	0.3
Overweight (BMI ≥ 25)	−0.0095 (0.0403)	−0.0	−0.0692 (0.0533)	−0.1
Obese (BMI ≥ 30)	0.1106 (0.0307)	0.6	−0.0019 (0.0399)	−0.0
Severely obese (BMI ≥ 35)	0.0682 (0.0175)	1.3	−0.0043 (0.0216)	−0.1
Irregular exercise or physically inactive	0.2669 (0.0665)	0.5	−0.0876 (0.0892)	−0.2
Physically inactive	0.3119 (0.0649)	1.1	−0.0272 (0.0887)	−0.1
Multiple health risks	0.1563 (0.0294)	1.5	0.0456 (0.0392)	0.4

Note: See note in Tables 2 and 4. The 24-month employment rate refers to average percent employed during the two years ending with the survey month. The quarterly rate refers to the average over the three months ending with the survey month.

the last quarter, relative to the two-year average, usually has small predicted effects—being correlated with slight increases in excess weight and physical inactivity, along with small to moderate decreases in tobacco use. In combination, these findings show that the lifestyle improvements associated with economic downturns occur with a delay and often follow an initial period where behaviors are unchanged or become less healthy.

6. Discussion

Lifestyle changes provide one mechanism for improvements in physical health during temporary downturns. A one point drop in the percentage of the population employed is estimated to reduce the prevalence of smoking, obesity, physical inactivity and multiple health risks by 0.6, 0.4, 0.7 and 1.1%. The decline in body weight is concentrated among the severely obese and groups with relatively high risk of early death (like males, African–Americans and Hispanics). Increases in exercise largely reflect movements away from complete inactivity and the reductions in tobacco use disproportionately involve heavy smokers. The macroeconomic effects are initially quite small but accumulate over time.

Declining time prices may provide one reason for the healthier behaviors. Decreases in work hours are associated with reductions in smoking, severe obesity, physical inactivity and multiple health risks. Conversely, there is not much evidence that the less risky lifestyles result from the accompanying fall in incomes.

These findings raise interesting questions. It makes sense that a rise in non-market time increases exercise and this direct effect might be reinforced if people are working less hard on their jobs and so are not as physically or mentally exhausted away from them. The parameter estimates for work hours might therefore combine the impact of variations in effort at both the intensive and extensive margins. There could also be other indirect effects, such as changes in sleep, that accompany the hours fluctuations and affect health .[45] More generally, since health is time-

[45] For example, Liu and Tanaka (2002) provide evidence that hours of sleep (work) are negatively (positively) correlated with the risk of non-fatal heart attacks.

intensive, the demand for both health and the inputs producing it is likely to rise when time prices fall (Grossman, 1972). This may help to explain why smoking (which is not time-intensive but is harmful to health) declines during bad economic times. The results for multiple health risks suggest further interactions between behaviors, such as the link between physical inactivity and smoking, or the possibility (not investigated here) that changes in tobacco use accompany variations in drinking.[46]

The findings of particularly large macroeconomic effects for heavy smoking, complete physical inactivity and severe obesity are generally not anticipated using the “rational addiction” framework (e.g. Becker and Murphy, 1988), which predicts relatively small responses to transitory price variations for strongly “addicted” individuals. However, larger impacts might occur if temporary changes are mistakenly interpreted to indicate permanent shocks and there are multiple (unstable) equilibria, discount rates are extremely high or decisions are made myopically.

These findings are part of a growing literature emphasizing the importance of individual decisions and economic factors in producing health. For instance, there are lively debates on the sources of the positive correlation between socioeconomic status and health and on whether income inequality has independent causal effects. The continuing uncertainties are highlighted in this analysis and provide exciting directions for future study.

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Appendix A See Table A1.

[46] Dawson (2000), for instance, documents a tight link between alcohol and tobacco use and shows that current drinkers (particularly heavy consumers) are relatively unlikely to have stopped smoking during the prior year.

Table A1
Detailed regression results for selected outcomes

Regressor	Smoker	Severely obese	Physically inactive	Multiple health risks
Employment rate	0.0013 (0.0003)	4.3E−4 (1.5E−4)	−0.0021 (0.0006)	0.0012 (0.0003)
Age	0.0137 (0.0001)	0.0073 (0.0001)	0.0033 (0.0002)	0.0102 (0.0001)
Age squared	−0.0002 (1.5E−6)	7.3E−5 (7.2E−7)	−4.3E−6 (1.6E−6)	−1.1E−4 (1.2E−6)
Female	−0.0371 (0.0008)	0.0164 (0.0004)	0.0157 (0.0010)	−0.0024 (0.0006)
Black	−0.0559 (0.0012)	0.0423 (0.0009)	0.0784 (0.0019)	0.0124 (0.0012)
Other non-White	−0.0045 (0.0022)	0.0017 (0.0011)	0.0887 (0.0030)	0.0111 (0.0019)
Hispanic	−0.0663 (0.0016)	0.0087 (0.0009)	0.0867 (0.0028)	−0.0071 (0.0013)
High school dropout	0.0652 (0.0013)	0.0216 (0.0007)	0.0937 (0.0016)	0.0582 (0.0011)
Some college	−0.0538 (0.0008)	−0.0048 (0.0004)	−0.0859 (0.0011)	−0.0404 (0.0006)
College graduate	−0.1548 (0.0008)	−0.0237 (0.0004)	−0.1552 (0.0011)	−0.0885 (0.0006)
Married	−0.0472 (0.0011)	−0.0177 (0.0006)	0.0141 (0.0015)	−0.0194 (0.0010)
Divorced/separated	0.0887 (0.0015)	−0.0131 (0.0006)	0.0401 (0.0019)	0.0304 (0.0013)
Widowed	0.0349 (0.0019)	−0.0061 (0.0008)	0.0306 (0.0022)	0.0108 (0.0015)

Note: See note in Table 2. The probit models also include month, year and state dummy variables, as well as dummy variables indicating missing information on marital status or education. Table shows the predicted effect of a one unit change in the specified variable (from the mean value for continuous variables and from zero to one for dummy variables) on the probability that the dependent variable equals one, with other regressors evaluated at the sample means.

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